

## PROGRESS OF MICROSCOPICAL SCIENCE.

---

*The American Hydrae.*—A note has been read before the Society of Natural Sciences of Philadelphia by Professor Leidy on the two species of *Hydra* common in the neighbourhood of Philadelphia. One is of a light brownish hue and is found on the under side of stones and on aquatic plants in the Delaware and Schuylkill rivers, and in ditches communicating with the same. Preserved in an aquarium, after some days the animals will often elongate the tentacula for several inches in length. The green *Hydra* is found in ponds and springs, attached to aquatic plants. It has from six to eight tentacles, which never elongate to the extent they do in the brown *Hydra*. In winter this animal is frequently observed with the male organs developed just below the head as a mammal-like process on each side of the body. He had not been able to satisfy himself that these *Hydræ* were different from *H. fusca* and *H. viridis* of Europe. Professor Agassiz had indicated similar coloured forms in Massachusetts and Connecticut, under the names of *H. carnea* and *H. gracilis*. Of the former he remarks that it has very short tentacles, and if this is correct under all circumstances, it must be different from our brown *Hydra*, which can elongate its arms for three inches or more.

*Remarks on Actinophrys Sol.*—Some observations made by Professor Leidy at one of the recent meetings of the Society of Natural Sciences of Philadelphia are not without interest.

Professor Leidy, after describing the structure and habits of this curious rhizopod, said that he had recently observed it in a condition which he had not seen described. He had accidentally found two individuals including between them a finely-granular rayless sphere nearly as large as the animals themselves. These measured, independently of the rays, 0·064 mm. in diameter; the included sphere 0·06 mm. He supposed that he had been so fortunate as to find two individuals of *Actinophrys* in conjunction with the production of an ovum.

Preserving the animals for observation, on returning after an absence of three hours, the animals were observed connected by a broad isthmus including the granular sphere reduced to half its original diameter. Two hours later the granular sphere had melted in the isthmus, leaving behind what appeared to be a large oil globule and half-a-dozen smaller ones. The isthmus in the former time measured  $\frac{1}{8}$  mm., at the later time  $\frac{1}{8}$  mm. Shortly afterwards, the isthmus elongated and contracted to  $\frac{1}{10}$  mm. on the left, while the right half, retaining the oil globules, remained as thick as before. At the same time the animals became flattened at the opposite poles. The latter subsequently became depressed, so that the animals assumed a reniform outline. The isthmus, now more rapidly narrowed and elongated, became a mere thread, and finally separated about one hour from the last two hours indicated. The oil globules were retained in

the right-hand individual, which, with the remaining projection of the isthmus, appeared broadly coniform in outline. In the left-hand individual all remains of the isthmus at once disappeared, and the animal appeared reniform in outline, but now contracting on the same side it assumed the biscuit form. The constriction rapidly increased, and in thirty minutes from the time of separation from the right-hand individual it divided into two separate animals presenting the ordinary appearance of *A. Sol*. Thus this second division took place in an opposite direction from the first. The right-hand individual, retaining the oil globules apparently unchanged, more slowly assumed the reniform outline, and then became constricted all around. The constriction elongated to an isthmus, in the centre of which were the oil globules. Three hours after the separation of the right-hand animal, the isthmus was narrowed to about half the diameter of the two new individuals which were about to be formed. At this moment other engagements obliged me to leave the examination of the animals. Six hours after, in the animalcule cage, I observed only half-a-dozen individuals of the *A. Sol*.

*The Fresh-water Algæ of North America.*—Students of our fresh-water algæ will find in the beautiful and interesting work of Dr. H. C. Wood, jun., says the 'American Naturalist,' 'A Contribution to the History of the Fresh-water Algæ of North America,' a ready means of identifying their specimens. It is a large quarto volume, with many coloured plates, and is taken from the Smithsonian Contributions to Knowledge.

*Development of Ferns without Fertilization.*—At a late meeting of the American Academy of Arts and Sciences, Prof. Gray communicated a paper by his former pupil, Dr. W. G. Farlow, now in Germany, on the development of ferns from the prothallium irrespective of fertilization, by a sort of parthenogenesis. The growth observed took place, not from an archegonium, but from some other part of the prothallium.

*Migration of White Blood Corpuscles.*—Dr. Thomas read, before the German Association of Naturalists at Wiesbaden, a paper on the migration of the white corpuscles into the lymphatics of the tongue of a frog, which is thus abstracted by the 'Lancet':—He injected the lymphatics of the living animal with an extremely dilute solution, not containing more than  $\frac{1}{80000}$ th to  $\frac{1}{80000}$ th part of nitrate of silver, and found that, with certain precautions, this did not lead to stasis of the blood in blood-vessels, but only to a lively exodus of the white corpuscles from their interior. After the lapse of some time, when the parts had begun to recover from the injurious effect of the injection, he was enabled to observe the re-entrance of the corpuscles into the lymphatic vessels, through certain stomata in their walls, now marked and rendered distinct by a precipitate of the silver salt. In a second series of researches the lymphatics were injected with a dilute emulsion of cinnabar, in a  $\frac{3}{4}$  per cent. solution of common salt. The cinnabar was in part deposited in the stomata of the lymphatics, and partly passed through them, and was deposited in the tissues in the form of

small, round, cloudy patches. The evidence of the identity of the stomata, brought into view by means of the cinnabar, with those rendered evident by the nitrate of silver, is obtained by observing their peculiar grouping, and by the subsequent injection of nitrate of silver into the same vessels. The injection of the cinnabar causes very little disturbance of the circulation. If a lively exodus of the white corpuscles from the blood-vessels be produced by making an abrasion of the surface, the migrating cells quickly make their appearance in the stomata of the lymphatics marked out by the cinnabar. They then take up the particles of the cinnabar into their interior, which causes them to lose their activity and accumulate in the stomata. They then appear in the form of cauliflower excrescences, projecting into the interior of the lymphatics, which gradually break up into their constituent cinnabar-holding cells. These may be traced into the larger vessels, and from them into the blood. In these researches, a remarkable regularity, or uniformity, in the track pursued by the white corpuscles, was observed. They pass away from the blood-vessels nearly at right angles into the tissues, their course, however, being in a series of short zigzags. They all appear to travel about the same pace.

*Persistence of Sensibility in the Peripheric Ends of Cut Nerves.*—A paper on this by MM. Arloing and Tripier, is thus abstracted in the 'Medical Record,' June 17th, by Dr. B. MacDowal:—1. The facial and the spinal nerves of solipeds and rodents possess recurrent sensibility as well as those of carnivora.

2. To find recurrent sensibility most readily, one must go to the periphery.

3. The peripheric end of the branches of the trigeminus nerve is sensible. This sensibility is somewhat difficult to demonstrate; still it exists.

4. The peripheric end of the nerves of limbs is also sensible. The sensibility may, however, disappear towards the nerve trunks.

5. In any case, the sensibility of the peripheric end is due to the presence of nerve tubes, the relations of which with the trophic and perceptive centres have not been interrupted by the section.

6. The absence of these tubes implies sensibility of the peripheric end.

7. These tubes proceed from the fifth pair, for the facial; from neighbouring nerves, and occasionally from nerves of the opposite side, for sensitive nerves; from neighbouring and homologous nerves, for the mixed nerves.

8. These recurrent nerves rise more or less high in the trunk of the nerve to which they are connected; their number diminishes from the periphery to the centre.

9. The return of these fibres may take place before the termination of the nerves, but the termination is the part where it is made by preference.

10. For several reasons, MM. Arloing and Tripier think that the sensibility of the peripheric end belongs to all nerves; and that it probably exists in all animals of the class mammalia at least.

*The Condition of Heart and Kidney in an obscure form of Disease*, which lately occurred in America, is thus described by Dr. L. Curtis:—"The piece of heart presented on the outside simple atheromatous and calcareous degeneration. The muscular fibres appeared healthy. The kidney presented a mottled appearance, part being of a cream-colour, other portions being of a natural colour, except much paler. I took two small pieces of this kidney and placed them in a weak solution of chromic acid, to harden. After a day or two, I cut some thin sections, both in a longitudinal and a transverse direction, and stained them in an alkaline solution of carmine. On examining the sections with the microscope, the whole field appeared confused, and it was only after repeated and prolonged examination that I was enabled to make out anything at all satisfactory. This was particularly the case over the greyer portions. The cause of this indistinctness was the infiltration of the organ with a granular substance. In some places this granular substance was replaced by round bodies resembling, in size and appearance, pus corpuscles; in other places there were collections of round bodies from one-third to one-half the diameter of the former; neither of these collections had well-defined boundaries. The edges of some of the sections, which were extremely thin, showed, where the granular material had been washed out, that the connective tissue of the kidney was somewhat thickened, and contained many more muscular points than in health. The Malpighian tufts were, in many places, contracted down into little compact knots, of cicatricial-like tissue. The uriniferous tubules were filled with a granular material; the cells lining them had lost their distinctive characteristics, and were cloudy and opaque. Most of the straight tubules were wasted to mere irregular, nodulated cords. These appearances do not correspond altogether with any specimen that I have met before, or with any description that I have seen published. I should dislike, at present, to give a decided opinion as to their nature; they correspond, however, more closely with what Rindfleisch calls *cellular hypertrophy of the connective tissue*, than anything else with which I am acquainted."

*On Tube-building Amphipoda*.—In 'Silliman's American Journal' for June, 1874, Mr. S. I. Smith gives the following account. He says, "In examining recently an alcoholic specimen of a species of *Xenoclea*, I noticed a peculiar opaque glandular structure filling a large portion of the third and fourth pairs of thoracic legs, which in most, if not all, the non-tube-building Amphipoda are wholly occupied by muscles. A further examination shows that the terminal segment (dactylus) in these legs is not acute and claw-like, but truncated at the tip, and apparently tubular. In this species, a large cylindrical portion of the gland lies along each side of the long basal segment, and these two portions uniting at the distal end pass through the ischial and along the posterior side of the meral and carpal segments, and doubtless connect with the tubular dactylus. There can be no doubt that these are the glands which secrete the cement with which the tubes are built, and that these two pairs of legs are specialized for that purpose. A hasty examination revealed a similar structure of the corresponding legs in *Amphithoe maculata*, *Ptilocheirus pinguis*, *Cera-*

*pus rubricornis*, *Byblis Gaimardi*, and a species of *Ampelisca*. In all these except the last two a very large proportion of the gland is in the basal segment. In the *Amphithoe* this segment is thickened and the gland is in the middle. In the *Cerapus* it is very broad and almost entirely filled by the gland, with only very slender muscles through the middle, and the orifice in the dactylus is not at the very tip, but sub-terminal on the posterior side. In the *Ptilocheirus* the gland forms three longitudinal masses in the basal segment and is also largely developed in the meral and carpal segments. The dactylus is long and slender and the orifice sub-terminal. In *Ampelisca* and *Byblis* (which, like *Haploöps*, are tube-building genera) the meral segments of the specialized legs are nearly as large as the basal, and contain a proportionally large part of the gland. In these genera the remarkable elongation of the two distal segments in the third and fourth pairs of legs is perhaps a special adaptation to enable them to reach back over the deep epimera.

*Retrogression of the Graafian Follicle.*—M. Slavjansky has recently written a paper in the 'Archives de Physiologie,' which is thus abstracted in the 'Medical Record,' June 15th:—"1. The Graafian follicles are developed from the primordial follicles, and acquire a greater or less degree of maturity during the whole of life, from the first month after birth till about the age of 40. 2. The greater part of the follicles are not ripe, do not burst, and do not discharge their contents, but undergo atresia, presenting an almost complete analogy with that of the formation of the corpora lutea. 3. The development and maturation of the Graafian follicles are not produced periodically in a regular manner, and no connection exists between them and menstruation. 4. Menstruation constitutes a physiological phenomenon, quite independent of the development and maturation of the follicles. 5. The rupture of follicles more or less mature always bears a certain relation to congestions of the genital organs, produced by any cause whatever. 6. There exist certain maladies (ague, poisonings, &c.) which produce atresia of the follicles at different periods of their developments, after a parenchymatous inflammation of the ovary."

*The Termination of Nerves in the Lips.*—Dr. Pallidino (*Bull. dell' Assoc. dei Naturali di Napoli*) states that in the lips of the horse, which are richly supplied with nerves, many isolated, non-medullated fibres run from the subcutaneous connective tissue into the deeper layers of the epithelium, when they have a straight course and terminate by free extremities after they have traversed the deepest layer of the pavement epithelium, occasionally exhibiting a terminal dilatation or enlargement. Pallidino has not been able to discover any connection of the nerve fibres with peculiar stellate cells of the rete Malpighii, as described a year or two ago by Langerhaus.

*Distinction between Mammalian and Reptilian Blood.*—The 'American Journal of Medical Sciences' says that Dr. R. M. Bertolet, M.D., Microscopist to the Philadelphia Hospital, refers to the great difficulty

which is experienced in determining the kind of blood, by the ordinary methods of examination in medico-legal cases.

If examined with the microscope, as it is ordinarily found in the dried state, the corpuscles are shrivelled and deformed. The addition of water extracts the colouring matter, and though it causes them to swell up, does not restore them to their original condition. It causes the red corpuscles to lose their bi-concave shape and approach the spherical. The oval disks of reptiles, birds, &c., lose something of their peculiar shape, and become more like mammalian blood.

In moistening such blood he uses a solution of sulphate of soda, or, better still, slightly acidulated pure glycerine. This preparation "is carefully irrigated with a properly prepared alcoholic solution of guaiacum resin: then, when a very small quantity of the ethereal solution of the peroxide of hydrogen (ozonic ether) is introduced beneath the glass cover," the red corpuscles are changed to an uniform colour, which varies in the different corpuscles, "from a light sapphire to a deep indigo blue."

In the nucleated corpuscles of birds, reptiles, &c., however, "*the nucleus is seen as a sharply-defined, dark blue body, while the protoplasm surrounding it assumes a more delicate violet hue.*" The distinction between the two kinds of blood, by this means, is so plain as to be evident even to an ordinary gentleman of the jury.

*What Pus is not.*—The following interesting paper is contributed to the 'Medical Examiner' (Chicago, U.S.A.) for April, by Dr. Lester Curtis, M.D. :—

"A few years ago Conheim published some observations on the white blood corpuscle, which confirmed the older observations of Waller and Beale, and called attention to them; for previous to this time they had attracted little notice, especially on the continent of Europe. These observations showed that, in inflammation, many of the white blood corpuscles pass through the walls of the capillaries, and appear outside of them. The corpuscles outside the vessels continue their amœbiform movements, and possessing the power of locomotion, were called 'wandering cells.' (?)

"At the time of these observations it was well known that the fresh pus corpuscle also had an amœbiform movement similar to that of the white blood corpuscle. Pus occurs as the result of inflammation; and where there is inflammation there are large numbers of wandering cells. Conheim concluded, therefore, that pus corpuscles came from the wandering cells, and, as the wandering cells came from the white blood corpuscles, therefore that a pus corpuscle was a white blood corpuscle. He rejected as erroneous the previous opinion that pus could be derived from any other source than the white blood corpuscles.

"Conheim's conclusion, that the pus corpuscle and the white blood corpuscle are identical, has been widely accepted. It is due partly to the acceptance of this theory that the name '*leucocyte*' has arisen—a name which is applied indiscriminately to the white blood corpuscle, the lymph corpuscle, the wandering cell, and the pus corpuscle. Some, in publishing their acceptance of the theory, have added the

saving epithet '*morphologically*' to the '*identical*,' evidently implying some doubt, after all, as to its correctness.

"In spite, however, of the general acceptance of the opinion, it appears to me to be inconsistent with certain well-known facts. It is my purpose to present some of these facts, and show wherein they are inconsistent with the theory. I shall consider the subject from Conheim's standpoint : supposing that all pus originates from white blood corpuscles, although I consider the proof of such sole origin as far from complete.

"In the first place, it by no means follows that, because a pus corpuscle is derived from a white blood corpuscle, it is identical with a white blood corpuscle. The white blood corpuscles are mere stages of growth, just as a chrysalis, or a tadpole, is a stage of growth. They have no particular function of their own, as, for instance, the red corpuscles have ; they only exist in order that they may be developed into something else. If this is the case, it is not only supposable that, under the changed conditions of nutrition to which the wandering cells are subjected outside the vessels, they should undergo a change ; but it is difficult to understand how they should continue to be the same that they were within the vessels.

"Mere similarity of form and appearance is, as we all know, one of the least reliable of resemblances ; and the fact that a pus corpuscle appears to be like a white blood corpuscle can surely go but a short way towards establishing their identity. The sporules of fungi can often be crushed, and the softer, central portion can be freed from the envelope. When this is done, the central portion of the sporule may resemble a white blood corpuscle so closely in every particular, except, perhaps, in size, that even an experienced observer would be unable to distinguish them apart. Would anyone, on this account, consider them to be identical ? There must be other resemblances between two bodies besides form and appearance merely, to render them identical. They must correspond in all essential particulars ; and if they differ in any essential particular, they plainly are not identical. Now let us see if pus corpuscles correspond in all essential particulars with white blood corpuscles.

"The white blood corpuscles of every healthy person correspond in every particular with which we are acquainted, with the white blood corpuscles of every other person ; and while there may be, and probably are, points in which the corpuscles of every individual differ from those of every other individual, these differences are so slight that the corpuscles of one person may be substituted for those of another, by transfusion of blood, without disturbance of function. If, then, pus corpuscles are the same thing as white blood corpuscles, all pus which has not a specific origin should be similar. I need hardly say, however, that this is notably not the case. No one would suppose for an instant that the pus from an ordinary abscess, and that from a purulent ophthalmia were the same. Yet the bland and unirritating pus from the abscess, and the highly contagious pus from the purulent ophthalmia, may have had their origin in a simple, and perhaps similar irritation ; and the white blood corpuscles

two individuals may preserve their similarity at the same time that the pus shows such great differences. Can things which differ from each other both be similar to the same thing?

"Again, the physiological action of pus differs from that of a white blood corpuscle. White blood corpuscles may easily, and with safety, be transferred from the vessels of one individual to those of another; but if pus is injected into the vessels, the result is a serious disturbance. The experiment has been tried of injecting pus into the veins of an animal; a febrile action, dangerous to the life of the animal, is the result; and if some of the blood of this animal is injected into the veins of a second animal, a still severer disturbance than in the first animal is set up. If the blood of the second is injected into the veins of a third, a similar disturbance is set up; and so of a fourth, and so on. The introduction of pus into the veins of the animal has given rise to profound changes in its blood—an effect differing widely from the harmless result of the introduction of the blood corpuscle.

"Again, the white blood corpuscles can become organized, and form tissue; or, at least, the wandering cells outside the vessels can become organized; and it is a well-known fact, that from these wandering cells all inflammatory new formations arise. Some, indeed, maintain that from such wandering cells are produced all the new growth of connective tissue, and all the new formations in the body. Pus, however, cannot become organized, as anyone who has observed the mischief done by a small quantity of pus beneath the periosteum of a finger can well appreciate.

"If pus, then, originated from a white blood corpuscle, it has lost the power of organizing; and who can tell how great is the difference which has resulted from that loss?

"Again, if the pus from our purulent ophthalmia, which may have arisen from a simple irritation, be introduced beneath the lid of a well person, it will, in all probability, set up a disease similar to that in the eye from which it was taken. If a white blood corpuscle had the property of setting up disease, what surgeon would be skilful enough to avoid purulent ophthalmia? The pus from purulent ophthalmia, then, has not only lost the power of organizing, but has acquired noxious properties, which render it hurtful to the person in whom it originated, and dangerous to those with whom it may come in contact. Can any two things differ more widely than the blood corpuscle and this pus—the one a useful and necessary part of the body, and the other a breeder of disease, and an object to be dreaded?

"In what I have said, granting what I do not believe, that all pus originates from white blood corpuscles, I have tried to show:—

"1st. That white blood corpuscles, being in a transition stage, we have no right to expect that, in the changed condition of nutrition to which they are subjected, outside the vessels, they would continue to be the same that they were within the vessels.

"2nd. That mere similarity of appearance was insufficient evidence of identity.

"3rd. That different samples of pus are unlike each other; which they would not be if they were white blood corpuscles.



"4th. That pus differs from white blood corpuscles.

"a.—In the disturbance which it sets up when introduced in these vessels.

"b.—In the loss of the power of organizing.

"c.—In the frequent acquisition of contagious properties.

"These are some, though by no means all, the reasons why I consider that pus is not the same thing as a white blood corpuscle. If I have established the point, it will be something gained; if I have failed, I would esteem it a favour to be shown my error."

*Structure of Boehmeria nivea.*—The structure of the aerial stem of *Boehmeria nivea*, a plant belonging to the nettle family, yielding the well-known China grass or Rhea fibre, was described by Mr. H. Pocklington, at a late meeting of the Leeds Naturalists' Field Club, as follows:—The central pith is peculiarly white and glistening to the naked eye. This is doubtless due to the excessive tenuity of the walls of the cells composing the medulla, to their being devoid of all proteinaceous contents, and to their inclusion of nothing but air when in the dry state. Most of the light incident upon them when viewed *in situ* will be totally reflected from the surfaces of the air within the cells, and thus give them the appearance of being illuminated by a clear lunar light from within. The medullary sheath is well developed, and consists, excluding the ordinary woody fibre, of large triple-spiral vessels, boldly barred *bothrenchyma* and long cylindrical cells containing a yellowish fluid soluble in alcohol. The fibre of the spiral vessels is strong, and easily separates from the primal wall of the cell, and the "barred" vessels are somewhat remarkable for their coarseness when contrasted with the vessels of the woody zone. The yellowish oil has not been investigated as yet, but appears to be a chlorophylloid product. The woody zone is well developed, and is remarkable for the nature of the cells of which it is composed. The normal spindle-shaped inactive much-thickened wood fibres are here replaced by thin-walled prosenchymatous cells containing, beside proteinaceous matter, large quantities of starch granules, and by less obviously wood-cells, minutely porous and also containing starch. Starch-bearing wood-cells have been described by Hassall\* and myself † as occurring in certain roots and rhizomes, but they have not, so far as I know, been hitherto described as occurring in aerial stems. The occurrence of them in roots is entirely unnoticed in our text-books, and is unknown to many botanists of extensive knowledge. The medullary rays are not evident in transverse section, but may be easily recognized in longitudinal sections. They are very much longer than broad, sometimes thickened, and contain little beside sap and starch. The *bothrenchyma* is interesting. The pits are oval, sometimes complete pores, and in the centre of a discoid, rhomboidal, or polygonal ternary deposit, with an irregular spiral of secondary deposit running between them. These are in fact very good examples of what are known as bordered pits, but must not be confused with the glandular *pleurenchyma* of conifers. The starch granules are varied in shape. The

\* 'Adulteration Detected.'

† 'Pharmaceutical Journal,' 1872-3.

larger number are round or ovoid, some are semi-mussel shaped, a few almost bacilliform; many are compounds of two, most are single granules. All give a black cross with considerable distinctness by polarized light. The cortical layers are chiefly remarkable for the liber fibres which constitute the China grass of commerce, and the small sphæraphides that accompany these linearly. The liber cells are, as shown long since by Quekett, very much stouter than those of flax, and are easily to be distinguished from them by means of a power of 300 or 400 diameters, the transverse markings in the two fibres being very different. The China grass fibres are very tough, their walls are considerably thickened, but they have a large central cavity filled with a mixture of gummy and proteinaceous matter. The result of this is that when the fibres are exposed to moisture after being dried then the contents absorb moisture, the fibres expand laterally and contract longitudinally, so that if they be woven into a fabric the chances are the fabric puckers in a very disagreeable fashion. This is certain to be the case if the fibres be mixed with wool as in certain Bradford manufactures. China grass fibres, however, will doubtless come into use provided a machine can be invented by which they can be economically removed from the hard woody stem. This latter will probably be utilized in the paper manufacture, and some mechanico-chemical means that will preserve the fibres uninjured whilst preparing the pleureuchyma for the paper-maker will probably be discovered one of these days. The other cortical cells do not require any notice. Their contents are chiefly what Mr. Sorby calls endochrome, granular matters of uncertain composition, and the small sphæraphides already referred to. These latter are almost certainly an impure oxalate of lime. The endochrome chiefly consists of yellow xanthophyll. Blue chlorophyll and, probably, small quantities of lichno-xanthine, passing by deoxidation into a pinkish-brown chromule, colouring the bark cells.

*The Etiology of Madura-foot.*—The 'Indian Medical Gazette' says it has recently received a pamphlet on this subject from Dr. H. Vandyke Carter,\* but after careful study of its contents has not been able to alter its opinion in the slightest degree. "This pamphlet and its accompanying plate may, we presume, be taken as an epitome of the author's previous writings and drawings in connection with this malady, doubtless embodying also the experience gained during the dozen years or so which have transpired since his views were first placed before the profession.

"These views are so well known that it is scarcely necessary to refer to them at any great length. Suffice it to say that Dr. Carter believes that he has shown that the disease is caused by a distinct fungus—a peculiar red mould, which has not been seen except in connection with Madura-foot. This mould was first observed by Dr. Vandyke Carter in May, 1861, 'upon part of a diseased foot which had been placed in water for maceration. . . . The next occasion of its

\* "The Parasitic Fungus of Mycetoma." By H. Vandyke Carter, M.D.—'Transactions, Pathological Society of London.' 1872-3.

occurrence was during the following year, in the month of April, in connection with a specimen of mycetoma preserved in spirits, and again, also about the same date, the mould was seen on some rice paste in which some fresh black fungus particles had been placed in order to ascertain if they could be made to grow artificially.'

"It will be observed that the mould referred to as having developed under these varying conditions was identified as one and the same kind of fungus—a fact which *per se* contains a sufficient refutation of the whole theory; for it is a physical impossibility that spores of fungi which had been preserved in spirits should retain their vitality, consequently the mould which grew on the spirit-preserved specimen *must have been of extraneous origin*; not only having germinated after the evaporation of the alcohol, but which must have originated from some source other than the interstices of the macerated tissue. We are therefore compelled to infer that the red mould, of various shades, described as having spread over portions of these three and other Madura-foot specimens, was but some developmental form of our ordinary pink-tinted moulds, bearing no relation whatever to the black, yellow, or orange-coloured particles frequently found in diseased tissues of this nature—no closer relationship, in fact, than a crop of various tinted mould on the surface of rice paste does to any coloured particles which may chance to be in its substance.

"No mould with which we are acquainted, however, presents the slightest resemblance to the pink-coloured objects figured in the plate, purporting to represent 'the structure of the red mould found in connection with mycetoma (*Chionyphe Carteri*)'—figures, by the way, differing materially from those appended to the original text in the 'Bombay Transactions,' or any others which we have seen elsewhere, and which, we presume, must be considered as representing the *Chionyphe Carteri* more accurately than the early figures. So long as the forms here delineated are associated in the mind with the idea of *moulds*, one is certainly puzzled to account for their presence; fortunately, however, a sentence in the descriptive text, attached to the plate, supplies us with a key: the objects depicted are referred to as representing 'a fragment of the new growth as this appeared upon a specimen of the foot-disease placed in water to macerate,' and a very good representation it is of 'fragments' which may very frequently be obtained in some specimens of tank water in which, however, no diseased foot need necessarily have been macerated.

"Looking at the drawing, without reference to the text, we should describe the objects as being, probably, some confervoid growths, and the 'spore capsule,' filled with pink-coloured globules, as the encysted gonidium of some Alga, not very unlike the gonidia of *Pandorina*, as figured in late editions of the 'Micrographic Dictionary,' or Pritchard's 'Infusoria.' To the Alga articles and plates of either of these volumes, or, better still, to some neighbouring tank at certain seasons of the year, we refer our readers for further explanation concerning the objects figured in this plate.

"It is with much regret that we write in this manner concerning any of the labours of so industrious and accomplished an observer as

Dr. Carter is known to be; but when we find a doctrine, which we believe to be altogether erroneous—the result of a misinterpretation of microscopic appearances—used by men of eminence (who themselves may not have the opportunity or possess the special training necessary for this particular branch of study) as a basis upon which to found the etiology of other diseases, we feel that the time has arrived for giving free expression to our opinion regarding it.”

*On the Smallpox of Sheep.*—Dr. E. Klein, Assistant Professor at the Laboratory of the Brown Institution, in a paper read before the Royal Society in June, 1874, says that *Variola ovina*, or smallpox of sheep, is a disease which, although it is not communicable to man, and possesses a specific contagium of its own, very closely resembles human smallpox, both as regards the development of the morbid process and the anatomical lesions which accompany it. This correspondence is so complete, that it cannot be doubted that the pathogeny of the two diseases is the same. The present investigation was therefore undertaken in the confidence that the application of the experimental method to the investigation of the ovine disease would not only yield results of value, as contributory to our knowledge of the infective process in general, but would throw special light on the pathology of smallpox.

The paper consists of four sections. In the first, the author gives an account of his experimental method, which consisted in communicating the disease by inoculation to a sufficient number of sheep, and in investigating anatomically (1) the pustules produced at the seat of inoculation, and (2) those constituting the general eruption. The lymph employed was obtained by the kindness of Prof. Chauveau, of Lyons, and Prof. Cohn, of Breslau.

In the second section, the organisms contained in fresh lymph, and the organic forms derived from them by cultivation, are described. The author finds that fresh lymph contains spheroidal bodies of extreme minuteness, which correspond to the micrococcus of Hallier and to the spheroids described by Cohn and Sanderson in vaccine lymph. It also contains other forms, not previously described, which in their development are in organic continuity with the micrococci.

The third section contains a complete anatomical description of the skin of the sheep with special reference to those particulars in which it differs from that of man.

The remainder of the paper is occupied with the investigation of the changes which occur in the integument at the seat of the inoculation, and with the anatomical characters of the secondary pustules.

The most important results are the following :—

1. The development of the primary pock may be divided into three stages, of which the first is characterized by progressive thickening of the integument over a rapidly increasing but well-defined area; the second, by the formation of vesicular cavities containing clear liquid (the “cells” of older authors) in the rete Malpighii; the third, by the impletion of these cavities with pus corpuscles and other structures. It is to be noted that the division into stages is less marked than in human smallpox.

2. The process commences in the rete Malpighii and in the sub-

jacent papillary layer of the corium; in the former, by the enlargement and increased distinctness of outline of the cells, and by corresponding germinative changes in their nuclei; in the latter, by the increase of size of the papillæ, and by germination of the epithelial elements of the capillary blood-vessels.

3. It is next seen that the interfascicular channels (lymphatic canaliculi) of the corium are dilated and more distinct; that the lining cells of these channels are enlarged and more easily recognized than in the natural state; and that, in the more vascular parts of the corium, the channels are more or less filled with migratory, or lymph, corpuscles. At the same time, the lymphatic vessels, of which the canaliculi are tributaries, can be readily traced, in consequence of their being distended with a material which resembles coagulated plasma.

4. About the third day after the appearance of the pock, the contents of the dilated lymphatics begin to exhibit characters which are not met with in ordinary exudative processes. These consist in the appearance, in the granular material already mentioned, of organized bodies, which neither belong to the tissue nor are referable to any anatomical type viz. of spheroidal, or ovoid, bodies having the characters of micrococci and of branched filaments. These last may be either sufficiently sparse to be easily distinguished from each other, or closely interlaced so as to form a felt-like mass.

5. The process, thus commenced, makes rapid progress. After one or two days, the greater number of the lymphatics of the affected part of the corium become filled with the vegetation above described; and on careful examination of the masses, it is seen that they present the characters of a mycelium, from which necklace-like terminal filaments spring, each of which breaks off, at its free end, into conidia. In most of the filaments, a jointed structure can be made out, and, in the larger ones, the contents can be distinguished from the enclosing membrane by their yellowish-green colour.

6. At the same time that these appearances present themselves in the corium, those changes are beginning in the now much thickened rete Malpighii which are preparatory to the formation of the vesicular cavities already mentioned. By a process which the author designates horny transformation, having its seat in the epithelial cells of the middle layer of the rete Malpighii, a horny expansion, or stratum, appears, lying in a plane parallel to the surface, by which the rete Malpighii is divided into two parts, of which one is more superficial, the other deeper than the horny layer. Simultaneously with the formation of the horny layer the cells of the rete nearest the surface of the corium undergo very active germination, in consequence of which the interpapillary processes not only enlarge, but intrude in an irregular manner into the subjacent corium. At the same time, the cells immediately below the horny stratum begin to take part in the formation of the vesicular cavities, some of them enlarging into vesicles, while others become flattened and scaly, so as to form the septa by which the vesicular cavities are separated from each other.

7. The vesicles, once formed, increase in form and number. Originally separate, and containing only clear liquid, they coalesce,

as they get larger, into irregular sinuses, and are then seen to contain masses of vegetation similar to those which have been already described in the lymphatic system of the corium with this difference, that the filaments of which the masses are composed are of such extreme tenuity, and the conidia are so small and numerous, that the whole possesses the characters of zooglæa rather than of mycelium. However, the author has no doubt that these aggregations are produced in the same way as the others, viz. by the detachment of conidia from the ends of filaments. In the earlier stages of the process the cavities contain scarcely any young cells. Sooner or later, however, so much of the rete Malpighii as lies between the horny stratum and the papillæ becomes infiltrated with migratory lymph-corpuscles. The process can be plainly traced in the sections. At the period of vesiculation, i. e. at a time corresponding to the commencement of the development of the vesicles in the rete Malpighii, the cutis (particularly towards the periphery of the pock) is infiltrated with these bodies. No sooner has the coalescence of the vesicles made such progress as to give rise to the formation of a system of intercommunicating sinuses, than it is seen that the whole of the deep layers of the rete Malpighii become inundated (so to speak) with migratory cells, which soon find their way towards the cavities, and convert them into microscopical collections of pus corpuscles, the formation of which is proved to be due to migration from the corium, not only by the actual observation of numerous ameboid cells *in transitu*, but by the fact that the corium itself, before so crowded with these bodies, becomes as the pustulation advances entirely free from them.

8. The concluding section of the paper is occupied with the description of the secondary eruption, the anatomical characters of which closely resemble those already detailed.

*On the Morbid Anatomy of Progressive Muscular Atrophy.*—In a very valuable pathological contribution,\* Dr. Lockhart Clarke has described the microscopical appearances observed in a case of muscular atrophy, accompanied by muscular rigidity and contraction of the joints. The parts received for examination were a slice of one of the cerebral hemispheres, the cerebellum, pons Varolii, medulla oblongata, and spinal cord. The white substance of the brain was rather thickly interspersed with corpora amylacea, from about twice the diameter of a blood disk to fourteen times that size. In the grey substance only a few of these bodies were present, and they were confined chiefly to the deeper layers. These are thus detailed by Mr. W. B. Kesteven in the 'Medical Record,' June 24th:—

It is here worthy of note that in chronic disease of the brain and spinal cord the presence of bodies, of varying size and far from uniform aspect, to which the name of amyloid bodies is generally given, is by no means uncommon. At the same time there are forms of degeneration of the neuroglia which give rise to appearances so closely resembling the so-called corpora amylacea that it is an extremely difficult thing to distinguish between them. Minute spots of miliary sclerosis,

\* 'Medico-Chirurgical Transactions,' vol. lvi. 1873.

and of colloid, are often to be seen in the same sections with the supposed amyloid bodies. The chromic acid, or other means employed to harden the nerve substance, so far alters its condition that the reactions of iodine or other tests for cellulose are controlled or obscured.

Dr. Clarke notes a dilated condition of the vessels, and in some parts a disintegration of these to the extent of causing their entire disappearance, with a consequent production of large, empty, and smooth-walled tubular spaces, which, according as they were cut transversely or obliquely, presented an appearance of round or oval vacuities. This appearance was first described by the author in a case of general paralysis of the insane,\* and has since been noticed also by other observers. It formed the most prominent feature of the lesions described by Dr. Dickinson in the medulla oblongata from several cases of diabetes. Dr. Clarke also refers to the dilated condition of the vessels, in connection with those spaces around them which have been spoken of as "lymphatic spaces," or "perivascular sheaths"; but which, the reporter has endeavoured to show, are the results of pathological, or even of merely *post mortem* changes.

The cells of the cerebral grey substances in this case were not altogether healthy. Some of them had lost their natural sharpness of outline; others contained rather more pigment than usual, or were somewhat granular at their surfaces. The pigmentation of cells was still more observable in the medulla oblongata. This change is considered by Dr. Clarke to constitute the first stage in the degeneration and subsequent disintegration of nerve cells. The medulla oblongata was one-fifth below the average size, and the diameter of the spinal cord was reduced by at least one-fourth; so much was it reduced that when first seen by Dr. Clarke, without any explanation, he thought it was the cord of a child of fourteen years of age.

The grey matter of the cord presented a variety of lesions. Congestion of the white columns was present. Hypertrophy of the connective tissue, with proliferation of its corpuscles, and aggregation of these in masses at the angles of junction in the network, are described by the author, and illustrated in an engraving. Several patches of disintegration were observed. One of large size consisted of small remnants of partly disintegrated grey substance, irregularly connected with each other, and forming together a kind of reticular or honey-comb structure. Several large areas of disintegration and hæmorrhagic clots existed, involving large portions of the cord in destruction. In all regions of the cord, the nerve cells had undergone degeneration and disintegration. Some were completely, others only partially, filled with dark-brown pigment granules, which in many instances enveloped and concealed their nuclei. All the remaining cells were reduced in size; many seemed to have been lost by gradual atrophy, and numbers had wholly disappeared by complete disintegration, or fallen into granules. The several stages of the process could be followed.

We have very imperfectly followed Dr. Clarke in the details of

\* 'Journal of Mental Science,' January, 1870.

the changes he records. They are well and clearly shown in the drawings by which the paper is accompanied. As the author remarks: "The symptoms in this case are very clearly explained by the morbid changes that were formed in the medulla oblongata and spinal cord. Lesions were traced in the nuclei of the facial, hypoglossal, vagus, and spinal accessory nerves, and explained the symptoms of glosso-pharyngeal paralysis. The extensive loss of substance in the anterior and lateral grey substance of the cervical and dorsal regions, more especially of the *tractus intermedio-lateralis*, explained feebleness of respiratory movements, while progressive changes of similar character in the lumbar and dorsal regions of course explained the paralysis of the upper and lower extremities."

*Bone-Absorption by means of Giant Cells.*—Mr. Alexander Morison,\* taking up the researches of Kölliker on absorption of bone by means of giant-cells, finds, says Mr. Klein, in 'Medical Record,' July 8th, 1874, on examination of sections through the jaw prior to the formation of the tooth-sac, that many giant-cells contain clear round or oval holes of various sizes. The larger and more distinctly defined ones, in the centre of which a débris resembling fatty particles is sometimes to be detected, appear to be originated by a disintegration of minute portions of the protoplasm of the giant-cell. From this the author takes it as possible that the giant-cells, after having ceased to exercise their destructive, i. e. absorbing function, become disintegrated. Morison takes it also as probable that sequestra are separated from living bone by means of giant-cells, for, on examining a fresh sequestrum, from a case of necrosis of the tibia, there were found Howship's lacunæ covering all aspects of the sequestrum, and the blood and pus around the preparation containing multinuclear giant-cells floating about.

As regards the origin of giant-cells, Morison agrees with Kölliker and others that many of them are in genetical connection with the osteoblasts, but that others probably develop from embryonic connective tissue; for there occur bone spaces with here and there a giant-cell entirely destitute of osteoblasts, but containing the nuclei of embryonic connective tissue. These nuclei, generally scattered, are here and there closely aggregated and show an internuclear opacity, which, however, has not the distinctly granular appearance of the opaque cell-substance of a fully developed giant-cell; but this appearance is in variable degree, even in fully formed cells. It is possible that the aggregation of nuclei may be the first stage in the formation of a giant cell; one has only to imagine that these nuclei prepare a cell material each around itself, which, coalescing with that round its neighbours, produces the multinuclear giant-cell.

*Morphology of the Saprolegnii.*—The 'American Naturalist,' June, 1874, says that this doubtful family, that seems now finally deposited in the Algæ, has considerable economic interest from the destructive effects produced upon fish eggs in the hatching trays, supposed to be caused by *Achlya prolifera*. The following summary is translated

\* 'Edinburgh Medical Journal' for October, 1873.



from advance sheets of "Contributions to the Morphology and Systematic Relations of the Saprolegniei," by N. Pringsheim.\*

The results of my investigations on the Saprolegniei may be condensed as follows:—

1. In all the Saprolegniei the male organs of generation develop from the well-known antheridia, that are formed near or grow toward the oogonia.

2. Those in which antheridia or their equivalents are wanting, are not, as has been supposed, distinct species, with modified organs, but parthenogenetic forms, whose sporangia ripen and bud without fertilization.

3. In the Saprolegniei there is but one kind of sporangia; those which develop parthenogenetically, and those which are fertilized are identical, and show no difference originally. The unfertilized zoospores grow sooner and more readily than those which are fertilized.

4. Several peculiarities in the formation of zoospores, which have been considered sufficient specific distinctions, are not important as such, but are merely evidences of a greater or less tendency to dimorphism, representing various stages of development in the zoospores.

5. Also various sexual forms of growth may appear in the same species, which are not reliable as specific distinctions.

*The Histology of the Brain in the Insane.*—Very many physicians who have given attention to this subject are of opinion that the structure of the brain is not materially, if at all, altered in disease. Now, however, a different view is expressed in a paper read before the Chicago Society of Physicians and Surgeons, and reported in the 'Medical Examiner' (a Chicago paper) for June 15. The paper in question was prepared by Dr. Walter Kempster, of the Northern Asylum for the Insane, at Oshkosh, Wisconsin, formerly of the New York State Lunatic Asylum, at Utica, and he had made microscopical examinations in forty-nine cases. Numerous slides were exhibited of sections, made mostly through the third left anterior cerebral convolution, illustrating the lesions of acute mania; the large sclerous patches in chronic mania; the dementia of syphilitic paralysis; one section through the olivary body, and one through the pons Varolii—each illustrative of acute mania.

Numerous micro-photographs were likewise shown, illustrating the lesions of cerebro-spinal meningitis; of numerous colloid masses in the medulla oblongata, and large degenerated masses with dense fibrous investing membrane in the spinal cord, opposite second cervical vertebra—each illustrative of acute mania. Also, a section through the olivary bodies, in a case of puerperal mania, showing fibres and connective tissue in degenerated masses.

After acknowledging the great abilities and researches of Lockhart Clarke, Virchow, Meynert, Schultze, Deiters, and others, in the study of the nervous system, Dr. Kempster remarks that, so far as he is aware, none of them have directed especial attention to the abnormalities found in the brains of those who die while insane.

\* 'Jahrbuch für wissenschaftlicher Botanik,' ix, Bd. 2tr. Heft.

Reference was made to an article in the 'Edinburgh Medical Journal' for September, 1868, by Dr. J. B. Tuke, as being the only exception which Dr. Kempster was able to find.

The student is met with the stereotyped phrase that there are no discernible lesions peculiar to insanity. For a number of years Dr. Kempster has been making systematic microscopical study of the brain, and has examined the lesions of all forms of insanity, from acute mania to dementia, including puerperal and epileptic insanity.

In each and all forms he has found a marked lesion—so that certain lesions may be grouped together as common to certain forms of insanity, and to which lesions any particular type of insanity is palpably due. There is a wide difference between the lesions of acute and chronic mania.

I. In certain forms of insanity, and notably in dementia, the finer capillaries show marked indications of disease, the perivascular sheath surrounding the vessel is distended, so much so, that sometimes the vessel itself appears to lay in a tunnel, its calibre being much less than the sheath, doubtless due to repeated capillary congestions of the vessels often diseased—irregular in calibre, suggesting the idea of aneurismal dilatations, but entirely distinct from the miliary aneurisms so ably described by Charcot.

II. Next, there is a degeneration, best studied in cases of dementia of syphilitic origin, and in the medulla oblongata, in the wall of the capillary, presenting dark red patches at various points outside its walls, which gradually thicken, and appear to be due to a fatty metamorphosis or atheroma. The description by Meynert, though accurate, is by no means so complete as could be desired.

III. In 1871, while examining a section taken from the grey and white matter of the third left anterior convolution, there was a peculiar appearance of the tissue. Situated in the white substance, but very closely to the grey matter, there were a number of small *white spots*, some round, some ovoid, clearly defined, in sharp contrast with the nerve tissue, varying in size, from 1–50 to 1–200 of an inch in diameter—these appeared to be of a granular consistence, and much more dense in structure than the surrounding brain substance; each disconnected from the other, and normal white matter intervening. They did not absorb carmine, and were not connected with the capillaries. On the surface of some of the spots are fibres of connective tissue and crystals of margarine. To determine the true character of these spots and the degeneration, certain very elaborate and extensive micro-chemical manipulations were made, not here necessary to be stated. On allowing a section to dry, either with or without the nitric acid treatment, these spots appear to project above the surface of the section. By teasing, they may with difficulty be removed. None of these spots have been observed in the grey matter. They are most numerous in the medulla oblongata, and may be found in the white matter of the spinal cord.

IV. There is another form of degeneracy, one which was found in cases of acute mania. The spots are less in size; are far more numerous than in the other variety (3); resist carmine staining; do not

possess the granular characteristic ; there are no spindle-shaped fibres of connective tissues about them ; they behave very differently under the micro-chemical tests applied to the other variety of spots. The points of resemblance are mainly in colour and apparent density. Neither of them have any investing membrane.

V. A fifth variety, as large in size as the third, possesses a dense investing membrane, which resists carmine staining and is less granular than the third and fourth. It exists in the same brain with the fourth variety. These spots or masses of the fifth variety are called "colloid," because of their resemblance to such growth, and are found in the medulla oblongata and pons Varolii. The last three varieties of degenerated masses, or spots, have one feature in common a well-defined edge, a clean-cut margin, easily made out.

VI. A sixth variety, common in cases of dementia, and where the atheromatous capillary is found, is one in which the mass passes insensibly into the surrounding normal tissues. This form is larger and less distinct than the others. It more nearly resembles normal brain tissues. Sometimes these masses are lobulated. They are granular and dense, less numerous than in the other varieties, and do not appear in clusters. They appear to destroy or transform the tissues, and if surrounding a capillary, destroy its walls. A point of resemblance in common with the third variety is, that connective-tissue fibre appears in both.

The condition of the cellular structures of the brain, of the nerve fibres and so-called lymph spaces, are all fields rich in results not here spoken of.

*The Development of Bone.*—Perhaps the first authority on this subject at the present moment is M. Ranvier, who lately read a paper on it before the French Academy of Sciences. This paper forms the subject of the following note, which is communicated by Mr. E. Klein to the 'Medical and Surgical Recorder' for July 15th. To study the growth and development of bone tissue, Ranvier uses the bones of the embryo, which are placed in absolute alcohol for twenty-four hours, having previously been freed of the surrounding soft parts (except the periosteum). After that, they are transferred to a saturated solution of picric acid, in which fluid they are kept until they become soft enough to be fit for sections. In order to make thin and successful sections, the softened bone is plunged into a thick solution of gum-arabic for forty-eight hours, and then into alcohol of forty degrees. Now it is easy to obtain very uniform sections through all parts of the bone, i.e. bone matrix, medulla, and periosteum. The sections having been washed in distilled water for twenty-four hours or more, in order to dissolve the gum, they are stained with picro-carminate of ammonia, and finally mounted in glycerine. In a longitudinal section through a long bone of an embryo of a mammalian animal, passing from the periosteum towards the axis, it is easy to see a well-marked boundary between the periosteal bone and the cartilaginous bone. The latter occupies the centre, and has an hour-glass shape in the longitudinal section, whereas the periosteal bone forms on each side a semilunar mass. The long bone at this stage of development may be correctly

compared to the following scheme: an hour-glass shaped cartilaginous bone is suspended in a cylindrical tube—the periosteum; that part of the space of the tube which is not occupied by the former is filled out by periosteal bone. This arrangement, although not found in all stages, is always present in a certain stage of the development of the bone. If one examine in a longitudinal section above mentioned the line of ossification, which represents at the same time the boundary between the cartilage and bone, there is found at the extremities of that line a notch penetrating into the cartilage. It is very easily understood that this notch represents the transverse section through a circular groove. From the convexity of this notch (“*encoche d'ossification*”), fibres take their origin, which, at their basis being identical with the matrix of the cartilage, bend round to the side of the embryonal bone and penetrate into the latter. These fibres, which Ranvier calls “*fibres arciformes*,” become in time identical with those fibres known as Sharpey’s fibres. Amongst the mammalian animals, the embryonal bones of sheep are best suited for the study of those fibres. As soon as these fibres have left the cartilage, they appear to be separated by rows of spherical or slightly polyhedral cells, which Ranvier believes to be derived from cartilage cells after their capsules have become opened. These cells gradually assume the characters of osteoblasts, and they lie all along the arched fibres, the latter becoming covered with bone substance, and thus representing the first traces of superiosteal bone. The arched fibres represent the directing fibres of the ossification; they can be recognized in the interior of the bone in transverse sections, where they appear as small dotted circles in the systems of the intermediary lamellæ.

On the external surface of that part of the cartilage belonging to the “*encoche d'ossification*,” a primary osseous lamella is formed, which Ranvier calls the perichondral bone-crust; it forms later on the boundary between the cartilaginous and the periosteal bone.

*Variation in the Condition of the External Sense Organs in Fœtal Pigs of the same Litter.* Mr. Burt G. Wilder, of Ithaca, N. Y., says that in comparing fœtal mammals of unknown age, it is natural to estimate their relative age, partly according to the degree of closure of the lids and the direction of the pinnæ; since it is known that the former are at first mere folds above and below the uncovered balls, which are gradually covered by them; and that the pinnæ are first formed as little triangular folds behind the meatus, which at first project directly forward, and then, as they increase in size, gradually rise to the erect position, and only later are retroverted upon the neck.

While forming a collection of fœtal pigs at the large *abattoir* of J. P. Squiers in East Cambridge, Mass., during the summer of 1872, I compared the individuals of the same litter, carefully avoiding any artificial displacement of the parts.

In the five pigs of the same litter\* having an average length from vertex to anus of .067, mm., and an average weight of .017·5 grams,

\* Marked 296 to 300 on the Catalogue of Neurology and Embryology of Domesticated Animals at the Museum of Comparative Zoology, Cambridge, Mass.

the direction of the pinna ranges from a slight but decided *anteversion*, to an almost complete *retroversion*.

In the seven pigs of another litter\* averaging  $\cdot 040$ , in length, the lids range from folds covering slightly the upper and lower margins of the ball, to complete closure. The sizes and degrees of closure do not exactly coincide. It would be interesting in both these cases to know the relative position of the individuals in the mother's uterine cornua; but these facts indicate the need of far more extended comparisons than have been made.

I have also observed some striking changes in the form of the nostril in foetal pigs; it is in its earliest condition a notch, whose lower margins then come together forming a hole; this elongates laterally and is indented above so as to become more and more crescentic; but at or before birth the circular form is regained and retained through life.

*To what Group is Peripatus related?*—In the very last number of the 'Proceedings of the Royal Society' is an admirable paper on this subject by Mr. H. N. Moseley, M.A., of the 'Challenger' expedition. Mr. Moseley enters into details concerning certain points in anatomy which appear to have been wrongly or imperfectly described before. Thus he describes fully the Intestinal, Tracheal, and Reproductive systems, and gives an outline sketch of the development. Then he goes on to say that "in the present state of our knowledge concerning the structure of *Peripatus*, the most remarkable fact in its structure is the wide divarication of the ventral nerve cords. The fact was considered remarkable, and dwelt upon in all accounts of *Peripatus* before the existence of tracheæ in the animal was known, and when it was thought to be hermaphrodite, but it is doubly remarkable now. The fact shuts off at once all idea of *Peripatus* being a degenerate Myriopod, the evidence against which possibility is overwhelming. The bilateral symmetry and duplicity of the organs of the body, the absence of striation in the muscles, of periodical moults of the larval skin in development, and of any trace of a primitive three-legged condition, taken in conjunction with the divarication of the nerve cords, are conclusive. The parts of the mouth are not to be regarded as degraded to any great degree; and homologies for some of them, at least, may perhaps be found amongst the higher Annelids. The structure of the skin is not at all unlike that in some worms, especially in its chitinous epidermic layer, which occasionally strips off in large pieces as a thin transparent pellicle. The many points of resemblance of *Peripatus* to Annelids need not be dwelt upon; they led to its former placing in classification; but it is difficult to understand how the very unannelid-like structure of the foot claws did not lead others, beside De Quatrefages, to draw a line between *Peripatus* and the Annelids. In being unisexual, *Peripatus* is like the higher Annelids, as well as the whole of the higher Tracheata. To Insects *Peripatus* shows affinities in the form of the spermatozoa, and the elaboration, structure, and bilateral symmetry of the generative organs,

\* Marked 303 to 309 in the same catalogue.

though there is a very slight tendency towards the unilaterality of Myriopods in the male organs.

"To Insects, again, it is allied by the five-jointing of the feet and oral papillæ and the form and number of its claws. It should be remembered that spiders' feet are two-clawed, as are those of some Tardigrades, and that some of these latter forms have two-clawed feet in the early condition even when they possess more claws in the adult state. In Newport's well-known figure of the young *Iulus* with three pairs of limbs, the tips of these latter are drawn with *two* hair-like claws; these are not mentioned in the text. To the ordinary lepidopterous larva the resemblances of *Peripatus* are striking—as, for example, the gait, the glands (so like in their function and position to silk-glands), the form of the intestine, and the less perfect concentration of the nervous organs, as in larval insects. To Myriopods *Peripatus* is allied by the great variety in number of segments in the various species, in its habits, and in these especially to *Iulus*. The parts of the mouth perhaps show a form out of which those of *Scolopendra* were derived by modification; but the resemblance may be superficial. Our knowledge is not yet sufficient to determine such points. The usual difficulties occur in the matter. Segments may have dropped out or fused, and their original condition may not be represented at all in the process of development. In structure *Peripatus* is more like *Scolopendra* than *Iulus*, viz. in the many joints to the antennæ (in Chilognaths never more than fourteen), in the form of spermatozoa, and in being viviparous, as are some *Scolopendræ*; further, in the position of the orifices of the generative glands and in the less perfect concentration mesially of the nerve cords in *Scolopendra*.

"*Peripatus* thus shows affinities, in some points, to all the main branches of the family tree of Tracheata; but a gulf is fixed between it and them by the divarication of the nerve cords: tending in the same direction are such facts as the non-striation of the muscles, the great power of extension of the body, the arrangement of the digestive tract in the early stage, the persistence of metamorphosis, and the nature of the parts of the mouth, the full history of the manner of origin of these being reserved.

"There are many speculations as to the mode of origin of the tracheæ themselves in the Tracheata. Professor Hæckel\* follows Gegenbaur, whose opinion is expressed in his 'Grundzüge der vergleichenden Anatomie,' p. 441. Gegenbaur concludes that tracheæ were developed from originally closed tracheal systems, through the intervention of the tracheal gills of primæval aquatic insects now represented as larvæ. If *Peripatus* be as ancient in origin as is here supposed, the condition of the tracheal system in it throws a very different light on the matter. *Peripatus* is the only Tracheate with tracheal stems opening diffusely all over the body. The Protracheata probably had their tracheæ thus diffused, and the separate small systems afterwards became concentrated along especial lines and formed into wide main branching trunks. In some forms the

\* 'Biologische Studien,' p. 491.

spiracular openings concentrated towards a more ventral line (*Iulus*); in others they took a more lateral position (Lepidopterous larvæ, &c.). A concentration along two lines of the body, ventral and lateral, has already commenced in *Peripatus*. The original Protracheate being supposed to have had numerous small tracheæ diffused all over its body, the question as to their mode of origin again presents itself. The peculiar form of the tracheal bundles in *Peripatus*, which consists of a number of fine tubes opening into the extremity of a single short common duct leading to the exterior of the body, seems to give a clue. The tracheæ are, very probably, modified cutaneous glands, the homologues of those so abundant all over the body in such forms as *Bipalium* or *Hirudo*. The pumping extension and contraction of the body may well have drawn a very little air, to begin with, into the mouths of the ducts; and this having been found beneficial by the ancestor of the Protracheate, further development is easy to imagine. The exact mode of development of the tracheæ in the present form must be carefully studied; there was no trace of these organs in the most perfect state of *Peripatus* which I obtained.

"Professor Gegenbaur's opinion on the position of *Peripatus*\* is, that its place among the worms is not certain, but that, at any rate, it connects ringed worms with Arthropods and flat worms. The general result of the present inquiry is to bear out Professor Gegenbaur's opinion; but it points to the connection of the ringed and flat worms, by means of this intermediate step, with three classes only of the Arthropods—the Myriopods, Spiders, and Insects, i. e. the Tracheata. From the primitive condition of the tracheæ in *Iulus*, and the many relations between *Peripatus* and *Scolopendra*, it would seem that the Myriopods may be most nearly allied to *Peripatus*, and form a distinct branch arising from it and not passing through Insects. The early three-legged stage may turn out as of not so much significance as supposed. If these speculations be correct, the Crustacea have a different origin from the Tracheata. *Peripatus* itself may well be placed amongst Professor Hæckel's Protracheata; Grube's term, Onychophora, becomes no more significant than De Blainville's Malacopoda. Some notions of the actual history of the origin of *Peripatus* itself may be gathered from its development.

"In conclusion I would beg indulgence for the many defects in this paper, due to the hurry with which it was written (all available time, almost up to the last moment of our sailing for the Antarctic regions, having been consumed in actual examination of the structure of *Peripatus*), and due, further, to the impossibility of referring to original papers in any scientific library. At all events it is hoped that *Peripatus* has been shown to be of very great zoological interest, as lying near one of the main stems of the great zoological family tree, and that further examination of the most minute character into the structure of this animal will be well repaid."

*Lesions of the Brain in General Paralysis.*—Dr. J. Batty Tuke gives the following instructive account of recent researches on this

\* 'Grundzüge der vergleichenden Anatomie,' p. 199.

subject. He says that Lubimoff's paper, published in Virchow's 'Archiv,' vol. lvii., 1873, is founded on fourteen carefully reported cases of general paralysis, which presented themselves in Meynert's 'Psychiatric Clinique.' The full history of each case is given, along with the *post mortem* appearances, naked eye and microscopic. Thin sections were made from specimens hardened in a 2 per cent. solution of bichromate of potass; they were coloured with carmine, and set up in gum Damar. The cortical substance of the frontal lobes was usually examined, and in some cases that of the parietal, occipital, and insular lobes, the cornu Ammonis, and other portions of the encephalon. Lubimoff reports one case in which a sort of cicatrix, or wedge-shaped induration, was found on the right hemisphere of the cerebellum, implicating two lobules which were glued together by a substance which unmistakably consisted of connective tissue. The molecular and nucleated layers were thinned, and Purkinje's cells almost obliterated. For the normal structure a dense "felt-like" substance was substituted, in which nuclei were imbedded, and which was intimately connected with the walls of the blood-vessels. Around it the undestroyed cells of Purkinje appeared plainly sclerosed. Lubimoff supports Meynert's observations as to the intimate relations of brain lesions with hyperæmia, that they never occur apart from it, and may be regarded as a consequence. In some cases the vessels showed indications of obstruction during life by means of thrombi, due to metamorphosis of blood-corpuscles into molecular masses, with here and there distensions filled with corpuscles, and in extreme cases actual rupture of the vascular walls and diffusion of the periphery (*Zerstreuung im Umkreis*) in the parenchyma of the organ. There were also found, in all the fourteen cases, on and around the vascular walls, pigment deposits of various sizes, and sometimes of very considerable extent, which are taken to be evidences of previously existing congestions. Apart from these consequences of hyperæmia, the walls of the vessels presented themselves altered and thickened; their normal coats and muscular striæ being destroyed, and the thickened walls appearing to consist of a homogeneous mass, waxy in appearance. On this Lubimoff bases his term of "waxy degeneration" of the vascular walls. The nuclei, especially at the bifurcations, appeared proliferated. Lubimoff cannot determine whether in general paralysis the vessels thicken themselves by an absolutely new growth.

The special characteristic of paralytic dementia presents itself in the changes of the nuclei of the neuroglia, which show themselves in the brains of such subjects wonderfully increased in quantity, to a degree which, according to Lubimoff, must be accepted as a pathological product, as preparations of healthy brains and of those taken from the subjects of other neuroses (e.g. extreme melancholy and mania), show but a slight amount of neuroglia corpuscles in the cortical substance. (In the opinion of Boll, who has inspected Lubimoff's preparations, this observation is of the highest pathological value).

What Lubimoff describes as nuclei of neuroglia are very fine Deiters' cells, which are well known through the works of Golgi,



Jastrowitz, and Boll; his description is entirely in consonance with that of these writers, and he arrives independently of them at the result, that a peculiar intimate connection exists between the vascular walls and the Deiters' cells, as in these cases their processes are peculiarly well pronounced.

Lubimoff found the Deiters' cells most abundant in the inner layers of the grey matter bordering on the medullary substance, and on the outer layer contiguous to the pia mater; in which position they were so numerous, that the normal appearances of the structures were lost, and their place taken by the felt-like network, which, as in the case of the cerebellum previously described, can only be ascribed to the interlacement in various directions of the processes of the Deiters' cells.

The morbid changes of the nerve cells are placed under two heads; they are liable either to a degree of swelling and subsequent collapse, or to a tendency to sclerosis. In the first case, the changes of the nuclei consist in dilatation of the nucleus and diminution of the quantity of the "surrounding protoplasm"; occasionally the nucleus subdivides so that two are found in one cell, and are not readily amenable to carmine, which Hoffman already has shown to be characteristic of the morbid ganglion-cell. Meynert considers that the protoplasm of such cells shows different degrees of molecular degeneration. The sclerosis of the cells changes them into a homogeneous wax-like mass, in which the nucleus is no longer to be distinguished, but occasionally the nucleolus. The protoplasm of such cells loses its normally fine granular appearance, the cells appear strongly refracting, with sharply defined dark contours. The changes in the axis-cylinders found by Lubimoff consist in thickening and hypertrophy.

It is deduced from these anatomical facts that as regards the pathological processes in general paralysis, the origin of the physical disturbances is to be sought for in the anomalies of blood distribution and its consequences. With the incidence of hyperæmia begin the changes in the nutrition of the nuclei of neuroglia, which leads to an increased development of their elements, which, in their turn, take on morbid action. This is proved by the modification of the morbid appearances, according to the length of time during which the case has lasted. The treatise concludes with deductions as to how the clinical symptoms of the individual cases are explicable by their special anatomical conditions. Lubimoff agrees with Westphal that disease of the cord is a constant accompaniment of general paralysis; but he differs from him and Simon in holding that the disease can exist without pathological changes in the brain. On the contrary, he endeavours to establish a chronic inflammatory condition of the connective tissue of the cortical substance as the anatomical lesion of general paralysis.—See also 'Medical Record.'

*Hay-fever, its Microscopy and Treatment.*—This has been very well discussed by Professor Binz of Bonn in a letter recently addressed to 'Nature.' He says, "From what I have observed of recent English publications on the subject of hay-fever, I am led to suppose that

English authorities are inaccurately acquainted with the discovery of Professor Helmholtz, as far back as 1868, of the existence of uncommon low organisms in the nasal secretions in this complaint, and of the possibility of arresting their action by the local employment of quinine. I therefore purpose to republish the letter in which he originally announced these facts to myself, and to add some further observations on this topic. The letter is as follows: \*—

“ ‘I have suffered, as well as I can remember, since the year 1847, from the peculiar catarrh called by the English “hay-fever,” the speciality of which consists in its attacking its victim regularly in the hay season (myself between May 20 and the end of June), that it ceases in the cooler weather, but on the other hand quickly reaches a great intensity if the patients expose themselves to heat and sunshine. An extraordinarily violent sneezing then sets in, and a strongly corrosive thin discharge, with which much epithelium is thrown off. This increases, after a few hours, to a painful inflammation of the mucous membrane and of the outside of the nose, and excites fever with severe headache and great depression, if the patient cannot withdraw himself from the heat and the sunshine. In a cold room, however, these symptoms vanish as quickly as they come on, and there then only remains for a few days a lessened discharge and soreness, as if caused by the loss of epithelium. I remark, by the way, that in all my other years I had very little tendency to catarrh or catching cold, while the hay-fever has never failed during the twenty-one years of which I have spoken, and has never attacked me earlier or later in the year than the times named. The condition is extremely troublesome, and increases, if one is obliged to be much exposed to the sun, to an excessively severe malady.

“ ‘The curious dependence of the disease on the season of the year suggested to me the thought that organisms might be the origin of the mischief. In examining the secretions I regularly found, in the last five years, certain vibrio-like bodies in it, which at other times I could not observe in my nasal secretion. . . . They are very small, and can only be recognized with the immersion-lens of a very good Hartnack’s microscope. It is characteristic of the common isolated single joints that they contain four nuclei in a row, of which two pairs are more closely united. The length of the joints is 0.004 millimetre. Upon the warm objective-stage they move with moderate activity, partly in mere vibration, partly shooting backwards and forwards in the direction of their long axis; in lower temperatures they are very inactive. Occasionally one finds them arranged in rows upon each other, or in branching series. Observed some days in the moist chamber, they vegetated again, and appeared somewhat larger and more conspicuous than immediately after their excretion. It is to be noted that only that kind of secretion contains them which is expelled by violent sneezings; that which drops slowly does not contain any. They stick tenaciously enough in the lower cavities and recesses of the nose.

“ ‘When I saw your first notice respecting the poisonous action of

\* See Virchow’s ‘Archiv,’ vol. xlv.

quinine upon infusoria, I determined at once to make an experiment with that substance, thinking that these vibronic bodies, even if they did not cause the whole illness, still could render it much more unpleasant through their movements and the decompositions caused by them. For that reason I made a neutral solution of sulphate of quinine, which did not contain much of the salt (1·800), but still was effective enough, and caused moderate irritation of the mucous membrane of the nose. I then lay flat upon my back, keeping my head very low, and poured with a pipette about four cubic centimètres into both nostrils. Then I turned my head about in order to let the liquid flow in all directions.

“The desired effect was obtained immediately, and remained for some hours; I could expose myself to the sun without fits of sneezing and the other disagreeable symptoms coming on. It was sufficient to repeat the treatment three times a day, even under the most unfavourable circumstances, in order to keep myself quite free. There were then no such vibrios in the secretion. If I only go out in the evening, it suffices to inject the quinine once a day, just before going. After continuing this treatment for some days the symptoms disappear completely, but if I leave off they return till towards the end of June.

“My first experiments with quinine date from the summer of 1867; this year (1868) I began at once as soon as the first traces of the illness appeared, and I have thus been able to stop its development completely.”

---

## NOTES AND MEMORANDA.

---

**Precious Stones in the Construction of the Microscope.**—M. H. Brachet addressed a note to the French Academy (June 22nd) on the employment of artificial precious stones in the compound microscope. This paper, which has not yet been published, was sent to the ‘Commission du Prix Trémont.’

**A Remedy for Phylloxera.**—At a meeting of the French Academy of Sciences, June 29th, a paper, forming a Report, was read on the administrative measures to be taken for the preservation of territories threatened by *Phylloxera*, by the Commissioners. It is suggested to the Academy that a special law should be made compelling proprietors to declare the first appearance of the scourge, that experts should then be appointed to examine into the state of the infested vines, and that these should be destroyed when thought necessary by ministerial decision, the proprietor receiving adequate compensation. It is further suggested to destroy the vines surrounding the districts actually invaded, to disinfect the soil by chemical methods, and to burn the cuttings, leaves, and roots of the diseased plants as well as the plants themselves in the same district where the uprooting has taken place, and finally to prohibit with the utmost rigour the exportation